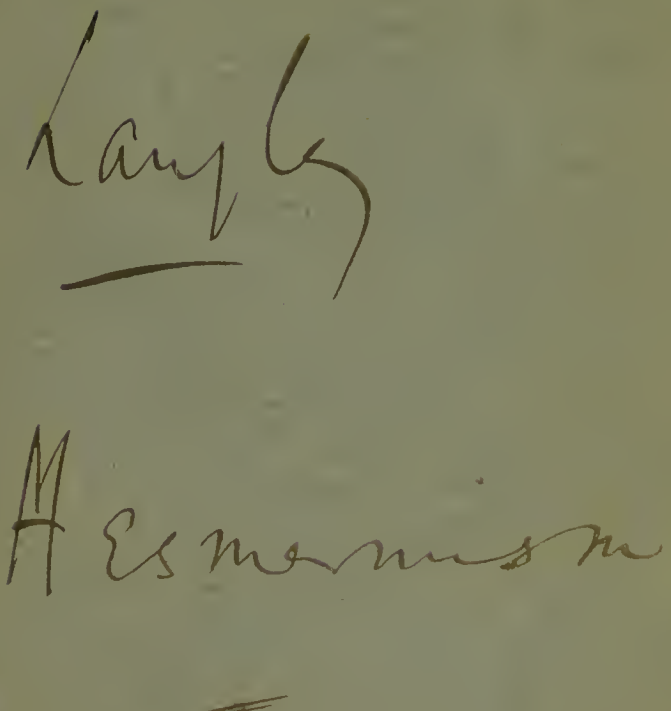

Royal Institution of Great Britain.

WEEKLY EVENING MEETING,

Friday, March 14, 1884.

SIR FREDERICK POLLOCK, Bart. M.A. Manager and Vice-President, in the Chair.

J. N. LANGLEY, Esq. M.A. F.R.S.

The Physiological Aspect of Mesmerism.

SCATTERED about in the literature of the seventeenth and eighteenth centuries are many records of the cure of divers human maladies in simple and mysterious-seeming ways.

Valentin Greaterakes, in Charles II.'s reign, was, we are told, "famous for curing various diseases and distempers by a stroak of the hand only." His power, he thought, was a special gift from heaven. Many people, however, were not slow to say that he had dealings with the devil. In some cases wonders were wrought by touching the affected parts of the patient with a magnet. Maxwell, who in 1679 published a short treatise on magnetic medicine, attributed the cures brought about by this, and by some other unusual forms of medical practice, to the accumulation of a subtile fluid in the body of the patient. This subtile fluid was diffused through all things in nature; a fortunate few amongst men had an inborn power of controlling its distribution. Such men could cure all diseases; they could indeed, he says, by adding to their own proper quantum of fluid, make themselves live for ever, were not the influence of the stars adverse.

In 1775 the theory of animal magnetism was put forward in Vienna by Friedrich Anton Mesmer. Neither his theories nor his facts differ very greatly from those of some of his predecessors. There exists, he said, in nature a universal fluid; in virtue of this, the human body possesses "properties analogous to those of a magnet; there are to be distinguished in it poles equally different and opposite, which may even be communicated, changed, destroyed, and restored; even the phenomenon of inclination is observed therein." By means of this magnetic fluid all the maladies of man could be healed. A few years later Mesmer left Vienna for Paris. At first he magnetised his patients by gazing steadily at them, or by means of "passes"; but as patients became more numerous, he brought them into a proper magnetic condition by other methods, often of a very fantastic nature. The patients did not, when magnetised, all show the same symptoms; some passed into a heavy sleep, some became insensible to touch, or even to stimuli ordinarily painful; some became cataleptic, some were seized with local or general convulsions. This last condition was called a crisis, and was the triumph of the mes-

meriser, the moment when the disease was considered to be forcibly expelled from the system. Now-a-days it is the last state a physician would care to produce in a patient.

For a time Mesmer's success was enormous. His admirers subscribed for him a sum of nearly 350,000 francs, receiving in return details as to the method of magnetisation. In Paris the belief in the power of Mesmer to cure diseases soon waned; but by this time he had made a stir in the world, and had drawn attention to a number of facts which were either only locally known, or largely disregarded.

Mesmer devoted himself chiefly to curing patients, and it must be added, to receiving fees; but about ten years after the time of his coming to Paris it was found that a state resembling somnambulism, or sleep-walking, could be produced in some persons by magnetising them. This gave a stimulus to the investigation of what I may call the magical side of the phenomena. This magical side had always been present, but in the height of Mesmer's power had not been much regarded. Of the magic of animal magnetism I will say one word more presently.

The term animal magnetism lingered long, but has now happily fallen into disuse, either mesmerism or hypnotism being used in its stead. "Hypnotism" we owe to Dr. Braid of Manchester, who, from 1841 to the time of his death in 1860, subjected all the phenomena said to be produced in the magnetic state to a searching investigation. Braid is the founder of mesmerism in its scientific aspect. Hypnotism and mesmerism, as commonly used now, are synonymous terms; it would be advantageous, I think, if we could make a distinction between them. We might, for example, use the term hypnotism to embrace all those phenomena which are proven, and the term mesmerism to embrace all those phenomena which are not proven. Mesmerism would then mean what I have called its magical side and would embrace those phenomena which are sometimes called the *higher* phenomena of mesmerism. These are of various kinds. It is said, for instance, that one person can, at any time he wishes, mesmerise another who is at a distance, and who is in perfect ignorance of the intentions of the mesmeriser; that a mesmerised person can perceive the thoughts and sensations of the mesmeriser, without receiving any indications from the known organs of sense; that a clairvoyant can see with parts of the body other than the eyes, for example with the back of the head, or with the pit of the stomach; that a clairvoyant can describe places and persons which he has never read of, or heard of, or seen. Those observers who have done most to elucidate the subject, such as Braid, have failed to observe any of these and other similar higher phenomena. They are unproven. It would be convenient, I say, to include such phenomena only, under the heading of mesmerism; but this I cannot yet venture to do. The facts I have to mention I shall call those of hypnotism or mesmerism indifferently. The magical side of the subject may, I think, at present be fairly left out of account.

Primarily, the hypnotic or mesmeric state is one in which the will is partially or wholly paralysed by certain sensory impressions; but there is no distinct line of demarcation between this and various other conditions, such as occur in sleep, somnambulism, and in some diseases of the central nervous system, such as hysteria. In each there is a typical state, but between them are many transition states.

Before discussing the mesmeric condition, I must say one or two words about the action of the central nervous system. I trust you will forgive me if, as very well may be the case, you find that part of what I say seems too simple to need saying, and part too complex and uncertain to be said without reservation. The one for the sake of clearness must needs be stated; the other for the sake of brevity must needs be dogmatic.

Here is a diagram of the brain and of the spinal cord of the frog. In this, all the chief structures of the brain of man are represented. For my present purpose it is only necessary to distinguish three divisions.

First there is the spinal cord. If a frog be decapitated, the brain is of course removed and the spinal cord is the only part of the central nervous system left. Yet if any part of the body of the brainless frog be gently stimulated, a particular movement results—a reflex action is produced. If, for instance, the right hind leg is gently pinched, this leg and this only is kicked out; if the left fore leg is gently pinched, this and this only is moved. Diagrammatically we may represent any one of these movements as being brought about in the following way. Pinching the skin stimulates the nerve endings of a sensory nerve, so that a nerve impulse—analogous to, but not identical with, an electric current passing along a wire—travels up the nerve to a sensory nerve cell in the spinal cord. In this nerve cell certain changes take place which result in an impulse being sent along another nerve to a motor nerve cell in the spinal cord. This is, in consequence, stimulated to activity and sends out a third impulse along a motor nerve to a muscle. The muscle then contracts, and the limb is moved.

If the brainless frog be pinched somewhat sharply, the movements which result are more extensive than when it is gently pinched, a spasm of the whole body may result. Referring to the diagram, we may represent this in the following way. The sensory cell being more strongly affected, sends out impulses to a number of other sensory cells on the opposite side of the spinal cord, and above and below it; these send impulses to their motor centres, and thus a more or less widely-spread movement results. This spreading out of impulses from the part immediately affected is called the irradiation of exciting impulses. When any part of the skin is stimulated, many sensory and many motor cells are affected; a collection of cells serving a common purpose is called a nerve centre. The spinal cord, then, consists of a collection of nerve centres. By appropriate

stimulation, any one, or all of these nerve centres can be set in activity.

The second division of the central nervous system is the posterior part of the brain—the brain minus the cortex of the cerebral hemispheres. This, like the spinal cord, consists of a collection of nerve centres, but the function of these nerve centres is much more complex than that of the centres of the spinal cord. A stimulus to the skin, which, when the spinal cord is the only part of the central nervous system left, will produce either a local movement or no movement at all, will, when the posterior part of the brain is also present, produce a general co-ordinated movement such as occurs in walking, jumping, swimming. In fact, all the co-ordinated movements of which the body is capable can be brought about by the activity of one or more of the lower centres of the brain. Moreover, these centres can be set in action by events which have no effect when the spinal cord only is present. Here a flash of light or a sudden noise sets in activity a nerve centre in a manner strictly comparable to the way in which a pinch applied to the foot sets in activity a nerve centre in the spinal cord; and just as in the spinal cord the active sensory centre may excite to activity a motor centre, and this may cause the foot to be moved, so in the lower centres of the brain the activity of the visual or auditory centre may excite to activity a motor centre and lead to a complicated movement such as shrinking or jumping. A frog with these two divisions only of the central nervous system does nothing of itself; it is without will and consciousness, in the same way that the frog with a spinal cord only, is without will and consciousness; it is a complicated machine, any part of which can be put in action by using the proper means.

The last division of the central nervous system is the *cortex* of the cerebral hemispheres. This part of the brain is concerned with ideas, with will, and with consciousness in the sense in which that term is usually employed, that is, speaking generally, it is concerned with the higher psychical functions.* In saying that this part of the brain is *concerned* with the higher psychical functions, I mean that every higher psychical act is accompanied by some definite change in the cortex of the cerebral hemisphere. I mean that every emotion, every idea, every effort of will is accompanied by an activity of nerve cells in this part of the brain and that this activity is comparable to the activity which takes place in definite cells of the spinal cord when a leg or arm of a brainless frog is pinched.

Here we touch the much disputed question of the localisation of the functions of the brain. Roughly speaking, this question is whether there are nerve centres in the cortex corresponding to those which exist in the rest of the brain and in the spinal cord:—

* It is not possible within the limits of this lecture to give the reservations that would be necessary in a full discussion of the subject.

whether, for example, visual sensation and ideas are accompanied by an activity of one part of the cortex, and auditory sensation and ideas are accompanied by an activity of a different part of the cortex; or whether visual and auditory sensation and ideas may occur in any part of the cortex, the mode of activity of the cells being different in the two cases.

Happily, it is not necessary to enter into this question in order to gain a fair idea of the chief features of mesmerism. The idea which we gain lacks no doubt definiteness in detail, and we must be prepared to express it in different language according as we find later, that the cortex of the cerebral hemispheres consists of one nerve centre with many functions, or of many nerve centres with different functions, or again as we find—and this is most probable—that the truth is between these two extreme theories.

But whilst we may put in the background the question of localisation of function for the cortex of the brain, we must linger a little to consider its mode of action. I will take a particular instance.

The changes which occur in the retina of the eye when rays of light from an external object fall upon it give rise to nervous impulses which eventually produce in the cortex of the brain a certain activity; this activity leads to our forming an idea of the object. Now in some cases the formation of the idea is all that takes place: often, however, impulses are sent out from the active cells of the cortex to a motor centre in the lower part of the brain, and a movement is made. This is a reflex action from the cerebral cortex. Here the active sensory centre excites a motor centre, just as happens in the spinal cord of a frog the leg of which is pinched. Our actions are often of this nature, though in many cases of course it is very difficult to say how far the will is exercised in the action. If you give a child a sweetmeat, the child sometimes no doubt deliberates what to do with it; in others the rapid transference of the sweetmeat to the mouth seems to be simply a reflex action entirely independent of any effort of will, though accompanied by consciousness.

Dr. Carpenter has introduced the useful term unconscious cerebration into physiological-psychology. By this is meant that the cortex may be active without our knowing anything about it. An instance which Dr. Carpenter gives, is that of trying to remember a name which for the moment we have forgotten, in such cases it is often best to give up consciously thinking, but the fundamental activities in the brain which accompany thinking go on nevertheless, so that presently without farther conscious effort, the name is remembered, is as it were thrown up into consciousness.

I said a moment ago that reflex actions not infrequently occur in which a conscious idea forms part of the reflex chain. But consciousness is not necessary to the reflex action; that is, the changes in the cortex which are the physical basis of the idea may be carried out without giving rise to consciousness. Here we want a term to imply that state in which everything necessary for an idea is present except

consciousness. Sometimes this is called an "unconscious idea," which would be convenient enough but that "idea" is generally taken to imply consciousness. It is an act of unconscious cerebration.

Reflex actions in which an unconscious cerebration forms part of the chain occur to all of us. Some time ago, whilst walking up and down the laboratory at Cambridge thinking intently on the result of an experiment, I noticed that the pipe which I had been smoking had gone out. Making up my mind to light it again, I walked to the place where the matches were kept, which happened to be close to a water-tap. As I went I began thinking again of my experiment. In a moment or two I was disturbed by a rush of cold water over my hand. I found that I had turned the water-tap, and let the stream of water run full into the bowl of my pipe. This was a reflex action from the cerebral cortex. The sight of the tap had given rise to what for this once I will call an unconscious idea, which had led to the somewhat complex movements of turning the tap and collecting the water in the pipe-bowl.

The central nervous system consists, then, of a vast number of nerve centres, each of which can be set in activity by an appropriate nerve impulse reaching it either by a peripheral nerve or from some other nerve centre. The action of these nerve centres is normally controlled by the will.

Here, at last, we come to mesmerism; the primary point in mesmerism is the paralysis of the will; the nervous system is then out of the control of the subject, whether animal or man, and by appropriate stimulation, any one or more of his nerve centres can be set in activity. I shall consider first the behaviour of the lower animals when mesmerised: in these the phenomena, as far as at present observed, are much simpler than they are in man. If a frog be turned over on its back, it at once regains its normal position; if, however, it be prevented from doing so, and its struggles are for a short time gently suppressed, it becomes hypnotised. Then, although it be left at liberty to regain its normal position, it will not attempt to do so. Apart from the movements it makes in breathing, it lies motionless. If it has been held for a short time only, the hypnotic state does not last long, usually from one to five or ten minutes; but, if the movements it makes, say at the end of one minute, of five minutes, and so on, are suppressed, it will not infrequently happen that the frog will then stay without farther movement for a considerable time, sometimes even for many hours. During the first part of this time a slight pinch, a sudden flash of light, or a loud noise, will usually cause it to turn over and sit up in its normal manner. For a moment or two it looks a little dull and confused, but rapidly regains its normal activity. During the latter part of this time it responds less and less to external stimuli. Reflex actions are less readily obtained, or may not be produced at all by stimuli ordinarily effective. Within certain limits, the longer the frog remains hypnotised, the more marked becomes its general insensi-

bility, the decrease in reaction being earliest distinct in the centres of special sense. When it is in this state, it may be propped up against a support with its legs crossed under it, or placed so that it rests on its head, or placed on its side with its legs arranged in this or that fashion, without offering the least resistance. Strong stimuli, or certain apparently lesser ones, for example a dash of water, cause it to recover its position slowly; it then usually sits for several minutes motionless, and only after some time regains its normal sensitiveness and activity. I show you here a frog in the early hypnotic state.

I have spoken of the frog as being hypnotised or mesmerised. Let us consider what is meant by this. I think it is obvious that the animal does not remain passive from any astuteness on its part; it is incredible that the frog, finding its efforts to escape ineffective, should make up its mind to remain quiet, and should, although at liberty to move, stay still for hours, becoming more and more determined as time goes on to take no notice of noises, of flashes of light, and of pinching of its skin. On the contrary, it is, I think, obvious that in some way its will has become paralysed. In order to attempt to explain how this is brought about, we must consider another aspect of reflex action, an aspect which is very little understood.

You remember that a brainless frog will, when its leg is gently pinched, kick out the leg; but if just previously some other part of the body has also been pinched, one of two opposite things may take place: the leg may be kicked out more quickly and vigorously, or it may not be kicked out at all. In both cases the nerve centre involved in producing the movement of the leg receives an additional impulse from another nerve centre, but in one case the additional impulse increases the activity of the nerve centre involved in the reflex action, in the other case it annuls this activity—there is, to use the physiological term, an *inhibition* of the "reflex" nerve centre.

To take another instance, a frog without its cerebral hemispheres, but with the rest of its nervous system, will croak when its sides are gently touched; but if at the moment of touching it, its leg be pinched, it moves or jumps, but does not croak. Here the motor centre which causes the movements of the muscles in croaking, receives nervous impulses from two sensory centres; one of these being set in activity by touching the sides of the frog, the other from pinching its leg. The impulses from the former tend to make the motor centre active, and so produce a croak; but the exciting effect of these impulses is annulled by the impulses coming from the latter centre; in other words the nerve centre involved in croaking is inhibited. Inhibition by impulses proceeding from the cortex of the brain occurs every day of our lives. The "will" is perpetually being brought into play to inhibit some nerve centre or other. For example, you may be on the verge of yawning, when it suddenly occurs to you that it will be better not to do so; you suppress the yawn without moving a muscle. What happens is this. An inhibitory nerve impulse is sent from the cortex, and puts a stop to the indiscreet activity of a

nerve centre elsewhere in the brain. Further, when the cortex is set in activity in a particular way by one impulse, another impulse reaching it may inhibit the first activity, or, in terms of the localisation theory, one nerve centre in the cortex may send out inhibitory impulses to any other nerve centre of the cortex.

I need not further multiply instances of inhibition. I wish, however, to lay stress on this, that it is highly probable that impulses travelling from any peripheral nerve-ending to a nerve centre, or from any one nerve centre to any other, may, under certain circumstances, diminish or annul the functional activity of the nerve centre, that is, may inhibit it. And there is equal reason to believe that, under certain other circumstances, the effect produced will not be inhibition, but an increase of activity of the centre. The exact conditions which determine whether one effect or the other takes place, have not as yet been made out. For the present the facts must suffice us. We may now return to the mesmerised frog.

Whatever the will may be, its action is accompanied by a certain activity of the cortex of the brain; if this activity is prevented from taking place, the will can no longer act. From the physiological standpoint, then, the mesmerised frog lies motionless because an inhibition of a particular activity of the nerve cells of the cortex has taken place. We may distinguish two chief causes of this inhibition.

The tactile stimuli sent to the central nervous system when the frog lies on its back are obviously different from those sent when the frog is in its normal position. The unusual nerve impulses travelling from the skin in the unusual position of the frog are inhibitory nerve impulses. There is reason to believe that they act first on some lower centre of the brain, and that from this, impulses are sent which diminish or annul the activity of the cortical nerve cells which is necessary for the exercise of will.

The second chief cause of inhibition is in the cortex itself. Handling the frog in the way which is done when it is mesmerised, produces a certain emotional condition which we may call fright. But when the animal is frightened, the nerve cells of the cortex are set in activity in a special manner. This mode of activity inhibits other modes of activity, and the will is paralysed.* We cannot at present, I think, put in any more definite form the effect of one state of the cortex of the brain upon its other possible states. We do not know enough of the relations of the cortex of the brain to the psychical functions to say more. In some cases fright seems to play a very small part, if any, in producing the effect. That it is not an essential factor is, to some extent, confirmed by the fact that a frog without the cerebral hemispheres can be easily mesmerised; it is

* The term "paralysis of the will" is here used to include the state in which there is an effort of will, but in which the effort is not followed by a despatch of nervous impulses from the cerebral hemispheres to the lower nervous centres.

difficult to conceive of the animal in this state being very much frightened.

It will be remembered that reflex action from all parts of the body is diminished in the mesmerised frog. After a time, then, there is a marked inhibition of activity of the whole nervous system. Now in the brainless frog placed on its back there is no such diminution of reflex action; hence in the intact hypnotised frog the spinal cord must be inhibited by impulses coming from the brain; from which we may conclude that centres inhibited in their own proper action, nevertheless send out inhibitory impulses to other centres. There appears then to be an irradiation of inhibitory impulses, just as we have seen that there is an irradiation of exciting impulses.

There are two other features in the hypnotised frog which I must mention, although time will not allow me to discuss them. It sometimes happens that soon after a frog has been hypnotised, reflex actions, instead of being more difficult to obtain than normally, are obtained more easily. Preceding the condition of reflex decrease there is a condition of reflex increase. Further, it sometimes happens that the hypnotised frog, instead of lying with its muscles flaccid, passes into a cataleptic state, so that its limbs tend to remain in any condition in which they are placed. Both the condition of reflex increase and that of catalepsy are more marked in man.

Before passing to mesmerism in man I will show you two other instances of hypnotism in the lower animals. The alligator which you see here behaves very much like the frog. It has, however, less tendency to become cataleptic. After a brief struggle, it becomes quiescent and its limbs slowly relax; its mouth may then be opened, and a cork placed between its teeth, without giving rise to any voluntary movement on its part. It may be kept for a considerable time in this limp condition by gently stroking the skin close to its eyes.

So far as I have observed, the hypnotic condition in birds and in lower mammals is not capable of any great development. It may last ten minutes, but rarely longer. In these animals, too, the emotional condition is probably the chief factor in producing the inhibition. Of impulses from peripheral sense organs, tactile impulses seem to be most effective in the lower mammals, as in the rabbit and guinea-pig, and visual impulses in the bird. The pigeon which I have here, remains longest quiescent when, after it has been held for a minute or two, I bring my hand slowly up and down over its head.

In man the phenomena of mesmerism are of a very much more striking character than they are in the lower animals. Speaking generally, this seems to be due to a greater interdependence of the various parts of the nervous system in the lower animals. In these, when any one centre is stirred up by exciting impulses, an irradiation of exciting impulses is apt to take place to all other centres, and the mesmeric state is in consequence apt to be broken. And on the other

hand, when a centre is inhibited, an irradiation of inhibitory impulses is apt to take place, and the whole nervous system is in consequence apt to be inhibited. Hence the activity or suppression of activity of particular parts of the central nervous system, which forms so conspicuous a feature of mesmerism in man, can be only partially produced in the lower vertebrates. Even in man there is very considerable difference, in different individuals, in the ease with which particular nerve centres can be excited or inhibited without other centres being similarly affected. But apart from this the fundamental features are the same, whether a man or a frog be mesmerised. The primary point is, as I have said, the paralysis of the will, that is, the inhibition of a certain activity of the nerve cells of the cortex of the cerebrum.

In man, as in the frog, this inhibition may be brought about either by impulses proceeding from the peripheral organs of sense, or by impulses originating in the cortex itself. Of the former class, tactile and visual impulses are most effective, although the mesmeric state may be produced by auditory and probably by other impulses. A man may, then, be mesmerised by passing the hands over or close to the skin, or by making him look steadily at an object, or listen intently to a sound.

Whether the inhibitory impulses so set up produce inhibition or not, depends upon the condition of the whole of the nervous system. The effect of the inhibitory impulses may be counteracted by exciting impulses coming from other parts of the central nervous system. In many people the exciting impulses are always sufficiently strong to overpower the inhibitory ones, and such people cannot be mesmerised. In others, the inhibitory impulses must be kept up for a long time, and repeated on successive days, before they acquire sufficient force to overcome the exciting ones. Such people are mesmerised with great difficulty.

The great majority of people cannot be mesmerised unless they consent to fix their attention on some particular object. This fixing of the attention, speaking generally, seems to be a voluntary exclusion of exciting impulses, leaving thus the inhibitory ones an open field. Idiots, who, on account of the lack of co-ordination of their nerve centres, cannot fix their attention for any length of time on any one object, cannot as far as I know be mesmerised. Now this, now that part of the brain becomes active, and exciting impulses are sent out which overpower the inhibitory ones.* Inhibition from impulses arising in the cortex itself are rare unless the patient has been previously mesmerised. Some such cases, however, do occur. But in people who have been previously mesmerised inhibition in this manner is of not unfrequent occurrence; within limits, the more often the changes in

* It is said that some persons, whilst they are sleeping, can be brought by means of passes into the mesmeric state. It would be interesting to observe if this can also be done with insane people.

the cells accompanying inhibition have been produced, the easier they are to reproduce. Those who have often been mesmerised may fall again into this condition at any moment, if the idea crosses their minds that they are expected to be mesmerised.

Thus if a sensitive subject be told that the day after to-morrow at half-past nine he will be mesmerised, nothing more need be done; the day after to-morrow at half-past nine he will remember it, and in so doing will mesmerise himself.

An instance sent by M. Richer to Dr. Hake Tuke, presents, it seems to me, an example of inhibition from the cortex which is of a somewhat different class, and more allied to that which occurs in birds and lower mammals. A patient was suspected of stealing some photographs from the hospital, a charge which she indignantly denied. One morning M. Richer found this patient with her hand in the drawer containing the photographs, having already transferred some of them to her pocket. There she remained motionless. She had been mesmerised by the sound of a gong struck in an adjoining ward. Here, probably, the changes in the cortex accompanying the emotion which was aroused by the sudden sound at the moment when she was committing the theft, produced a widespread inhibition—she was instantaneously mesmerised.

I will show you the method of mesmerising which is, perhaps, on the whole, most effective; it is very nearly that described by Braid. I have not time to attempt a mesmeric experiment to-night, it is the method only which I wish to show you. With one hand a bright object, such as this facetted piece of glass, is held thus, eight to twelve inches from the subject, so that there is a considerable convergence of the eyes, and rather above the level of the eyes, so that he is obliged to look upwards. The subject is told to look steadily at the piece of glass, and to keep his whole attention fixed upon it. This position is kept up for five to ten minutes; during this time the pupils will probably dilate considerably, often assuming a slight rhythmic contraction and dilation; when this is the case the free hand is moved slowly from the object towards the eyes. If the subject is sensitive, the eyes will usually close with a vibratory motion. In some cases the subject is then unable to open them, and the usual mesmeric phenomena can be obtained. If when the operator brings his hand near the eyes of the subject, the subject instead of closing them follows the movements of the fingers, the whole proceeding is repeated, but the subject is told to close his eyes when the fingers are brought near them, but to keep them fixed in the same direction as before, and to continue to think of the object and that only. The operator then for some minutes makes "passes," bringing his warm hands over and close to the face of the subject in one direction. When the subject is inclined to pass into the cataleptic state, an indication of his condition may be obtained by gently raising his arm; if he is beginning to be mesmerised, the arm remains in the position in which it is placed. If the arm falls, the mesmeric state may not infrequently be hastened on by

telling the subject to keep his arm extended whilst he is still gazing at the object, or whilst the passes are being made. And that is the whole of the process. The man thus mesmerised sinks from manhood to a highly complicated piece of machinery. He is a machine which for a time is conscious, and in which ideas can be excited by appropriate stimulation; anyone acquainted with the machinery can set it in action.

The distinguishing feature of the earlier stages of mesmerism in man is that by slight stimulation any one centre can be easily set in violent activity, and its activity easily stopped, without the activity spreading to other distant centres. It is on this that the mesmeric phenomena usually exhibited depend; with most of these phenomena you are no doubt familiar, so that I need mention one or two only.

Complicated reflexes may be produced in various ways, just as we have seen is the case with a frog even when without its cerebral hemispheres. Thus Braid mentions that on one occasion an old lady who had never danced, and who indeed considered it a sinful pastime, when mesmerised began to dance as soon as a waltz tune was played.

A statement made to a subject will often produce implicit belief notwithstanding the evidence of his senses. I remember telling a subject that I was about to bring a hot body near his face, and he was to tell me when it was painful. I put my finger on his cheek, upon which he cried out violently that I was burning him. When he was awakened he remembered that I had touched him with something very hot. The idea I had given him was remembered, the evidence of his sense of touch was disregarded. Even in ordinary, apparently wakeful, life an idea may produce a belief in no way borne out by the evidence of the senses. Dr. Beard narrates that once when crossing the Atlantic, the steamer he was in ran into a sailing-vessel. It was at night, and amidst the roar of the wind, the shrieks, and cries, and prayers of the passengers, the cry went forth that the steamer was stove in and the bow sinking; straightway all eyes were turned to the bow, and to every eye it seemed to be sinking. "I shall never forget," he says, "how it gradually lowered in the darkness." In fact, however, the vessel was uninjured, and the bow did not sink at all. Here probably the majority of the people present passed simultaneously into a condition resembling the mesmeric condition; the idea presented to them by the cry "the bow is sinking" being more powerful than the ideas aroused by the objects actually seen.

But even in the absence of strong emotion, it may happen that an idea suggested by a statement may be more powerful than the proper sensory impression. There are some persons, apparently perfectly trustworthy, who nevertheless, if they were told to look closely at the top of this bell jar and see the faint flame coming from it, would very soon see the flame quite distinctly. In health, as well as in disease,

there are many partial revelations of the condition produced by mesmerism.

In some subjects the sensibility of the skin to variations of temperature is very greatly increased, so that the contour and size of an object which is brought near the skin can be recognised by the alteration in the feeling of temperature of the part. The size and contour of an object such as a book or a coin being thus known, the subject may of course be able to guess that a book or coin is being held before him.

There are certain attitudes which we usually assume under the influence of certain moods or ideas; from each of the muscles concerned in bringing about any one attitude, impulses travel up to the brain, and give rise to a definite muscular sensation which comes therefore to be associated with a particular mental mood. In mesmerised people the production of a definite muscular sensation not infrequently produces in the mind the mood with which it is, in the wakeful state, associated. At the same time ideas may be produced corresponding to the mood, and the ideas may give rise to particular actions, such as laughing, crying, fighting.

If the head is pushed back and the shoulders opened out, the face assumes a look full of pride or haughtiness, and if the subject be asked what he is thinking about, he will give some answer indicating what a fine fellow he fancies himself to be. If, then, the head is bowed and the shoulders contracted, the aspect of the face changes to one of humility and pity. Occasionally it happens that a slight pressure on a single muscle, which causes it to contract, will by an irradiation of nerve impulses produce the muscular sensations proper to a group of muscles, and this will give rise to the associated frame of mind. Thus very different feelings may be made to rapidly succeed one another in the mind of the subject by simply pressing on various muscles of the head and neck. At first sight such an experiment looks like a revival of the now happily forgotten phrenology.

I have said that in a frog which remains mesmerised for any time, there is a considerable reflex depression, i. e. inhibition of the whole of the central nervous system—that there is an irradiation of inhibitory impulses. In man a similar irradiation of inhibitory impulses appears to take place; usually a mesmerised person if left alone passes gradually, but often rapidly, into a state of torpor; consciousness disappears, memory is lost, reflex action becomes difficult to obtain, finally, it may be, there is complete anæsthesia, a limb may be cut off without producing any movement or any pain; since this torpor comes on without anything farther being done to the subject, we may conclude that here, as in the frog, but to a much more marked degree, there is an irradiation of inhibitory impulses. The primarily inhibited centres send out inhibitory impulses to all other nerve centres. Up to a certain stage, possibly throughout, any one or more centres may be brought back to a condition of activity by certain exciting stimuli, but when these cease the inexcitable condition is

soon brought back by the inhibitory impulses streaming to them from other nerve centres.

The extent to which the torpid condition develops itself, varies in different individuals. It depends upon the condition of the nervous system, upon the relative intensities of the inhibitory and exciting impulses. As far as our present knowledge goes, it would appear that a few only of those who can be mesmerised, can be made to pass into a condition of complete anæsthesia. It is possible, however, that this may be due to the passes which give rise to inhibitory impulses not being continued long enough. Dr. Esdaile, who in India was accustomed to mesmerise his patients before performing surgical operations upon them, used to continue the passes for one to two hours, and often to repeat this for several days in succession.

In different people the order in which different centres are inhibited varies, as we should expect from the unequal development of different centres in different people. This is no doubt of influence in determining whether the general state is cataleptic, somnambulistic, or lethargic, and here probably the method used to mesmerise is also of considerable importance; it would seem that the cataleptic condition is more likely to be developed when the process of mesmerisation involves a strain on the eyes of the subject, than when he is mesmerised by passes. Not much attention, however, has as yet been directed to this point.

There can, I think, be no doubt that mesmerism may help, and sometimes cure, persons suffering from certain diseases of the nervous system. It is not in our power to make any accurate statement of the way in which this is brought about; but since disease may be the result of either an over-activity or of an under-activity of any part of the central nervous system, it is reasonable to suppose that a beneficial effect will follow the employment of a method which allows us to diminish or increase these activities as we will. This is a side of the question which is of the greatest interest both to physicians and to physiologists—to physiologists, since it bears directly upon the problem of the influence of the nervous system on nutrition. There is good reason to believe that by directing attention strongly to any particular part of the body, the nutritive state of that part of the body may be altered. The determination of the actual way in which this is brought about is full of difficulties, but the following way is at least theoretically possible. It may be that the nerve centres connected with the tissue in question are made unusually active, and that they send out nerve impulses of a trophic nature, that is, impulses which directly control the nutrition of the tissue. The alteration in the tissue caused by its changed nutritive state—its changed metabolism—may conceivably be either beneficial or detrimental to the whole organism; it may give rise to a diseased state, or get rid of an existing one.

The modern miracles of healing, wrought in persons in a state of religious enthusiasm, offer a field for investigating this problem; the

field, however, is a particularly bad one, and chiefly because so many people concerned regard any careful examination of the subject as impious. But in mesmerised persons it seems probable that such investigations could be made on a fairly satisfactory basis. Men when mesmerised gradually lose remembrance of those things which they remember when they are awake, but not infrequently other things are remembered which are forgotten in the waking state.* This is normally the case with a person who has been previously and recently mesmerised. He may then remember little else than what took place in the corresponding stage of his previous mesmerisation. In a certain state, then, an event or a command will produce in the central nervous system those changes which are necessary for the event or the command to be remembered later, without ever rising to consciousness in the waking condition. Thus a command to do a particular thing, given to a subject in this mesmeric stage, may be carried out when he awakes, although he is quite unconscious why he does it. We may say that such an act is one of unconscious memory. But it is, I think, something more than this. The subject is usually uneasy and preoccupied until the thing is done; he is to a greater or less extent unable to fix his attention on other things; he is, in fact, in a state of unconscious attention to an unconscious memory. This brings us to our point. It suggests that if a subject in a certain stage of mesmerisation be told that in a few days a sore will appear upon his hand, or conversely that a sore already there will disappear, the conditions which accompany conscious expectation and attention, will to a certain degree be established; and the trophic influence of the nervous system on the tissues may be tested in a manner which puts the experiment fairly within the control of the observer, and to a certain degree excludes imposture. Such an experiment has obviously some drawbacks, it would probably only succeed, if it succeeded at all, with a person whose nervous system was in a state of unstable equilibrium; and it can hardly be expected that the effects would be so striking as when conscious expectation is also concerned. Still observations of this kind are well worth attention, on account of the medical, the physiological, and the psychological issues involved in the results.

A lightly mesmerised subject can be easily brought back to a normal condition by a sudden slight shock, by sprinkling water in the face, or by a current of cold air. These give rise to exciting impulses which arouse to normal activity the inhibited parts of the brain; just as we have seen that any other part of the central nervous system can

* A case is recorded by Braid, of a woman who, during natural somnambulism—which is almost identical with a state that can be produced by mesmerism—could repeat correctly long passages from the Hebrew Bible, and from books in other languages, although she had never studied any of those languages, and was quite ignorant of them when she was awake. At length, however, it was discovered that she had learnt the passages when she was a girl, by hearing a clergyman with whom she lived read them out aloud.

be aroused to activity by slight exciting impulses. There is no mystery in this, beyond the mystery which lies in the relative action of all exciting and inhibitory impulses. The power of responding in strikingly different ways to weak stimuli differing in kind, or to stimuli apparently of the same kind, but differing in intensity, is not peculiar to the nervous system of man; it is a power possessed by the nervous system of all animals, and indeed, not improbably by all living substance. This has already been touched upon in what I have said of inhibition, but I will give you one or two other instances of the dissimilar effects produced by slight, and apparently not very dissimilar, stimuli, instances which are especially pertinent to the subject of mesmerism. These we owe to Heidenhain.

When morphia is given to a dog, and the animal is left undisturbed, it passes into a condition resembling sleep; but a little investigation usually shows that the condition differs in certain notable respects from sleep. Whilst consciousness, as far as can be told, is gone, and voluntary movement is abolished, many reflex actions can be obtained much more readily than in the waking state; moreover, there is a tendency for the muscles which contract in a reflex action to remain contracted, the nerve centres when set in activity remain active for a considerable time, and continue to send out impulses to the muscles, which in consequence are kept contracted; in other words the reflex contraction produced by a slight stimulus applied to the skin is of a tonic instead of a tetanic nature. Now this tonic contraction can be brought to an end by various slight stimuli, for instance by lightly stroking the skin over the contracted muscles, by gently tapping the contracted part, by blowing in the face of the animal, or by stimulating the cortex of the brain by a weak electric current. Nevertheless, the acts just mentioned may, when the muscles are not contracted, cause or help to cause, their contraction. I will give an instance of this. Electrical stimulation of a definite part of the cortex of the brain causes a tonic contraction of certain muscles of the leg, in consequence of which, let us say, the leg is bent and remains so. Now we have seen that passing the hand over the skin of the leg will cause it to unbend; well, if the cortex of the brain be stimulated with an electric current, not quite strong enough to produce of itself bending of the leg, the bending may at once be produced by gently stroking the leg at the same time as the cortex is being stimulated. Of a similar nature is the effect of electrical currents of different strengths. When a limb has been brought into a state of tonic contraction by electrical stimulation of a certain part of the cortex of the brain, a weaker electrical stimulation of the same spot of the cortex will bring the tonic contraction to an end.

The phenomena just described as occurring in a dog under the influence of morphia, closely resemble those often observed in human beings when mesmerised. Commonly in a mesmerised person the arm, let us say, may be made to bend by gently stroking the skin over

tho appropriate muscles; give a slight tap on the arm, and it relaxes. Braid observed in some subjects that if a limb was made rigid by passing tho hands over it, and if it was left extended for a short time, then the repetition of the same act of passing the hands over tho limb caused the rigidity to disappear. It is unnecessary, I think, to consider in detail the corresponding states in the narcotised dog and tho mesmerised man; enough has been said to show that in both certain slight stimuli produce, sometimes excitation, sometimes inhibition.

It must, however, be noted, that our conception of inhibition is not rendered clearer by these facts; for it would appear from them that a nerve centre may be excited or be inhibited by the same nerve impulse, the result depending upon the condition of the nerve centre. This is not a necessary inference, but it is perhaps at present the most convenient working hypothesis. A certain group of facts, indeed, may be held together and receive a provisional explanation by saying that in some conditions of the central nervous system, a stimulus excites a nerve centre if it is quiescent, and inhibits it if it is active.

It seems to me probable that what is called the "transference of contracture" and the "transference of sensation" are of the same order of facts. These phenomena are exceedingly curious. Suppose that the left biceps of a mesmerised person be gently stroked or pressed, so that it contracts and remains so. The continuous contraction of the muscle is called contracture. In consequence of the contracture, the arm is kept bent. Suppose that the biceps of the other arm be gently stimulated, we may get a transference of the contracture, i. e. the right biceps becomes contracted and the right arm bent, whilst the left arm which previously was bent, falls flaccid. Similarly there may be a transference of sensation; thus the right arm say is rendered insensitive, so that pricking it with a needle does not give rise to any sensation; on the back of the right hand, a piece of metal, such as a two-shilling piece, is now placed, and left for a short time. On removing it, it is found that the spot of skin which was in contact with the metal has become sensitive, so that the prick of a needle is at once felt, but that the corresponding part of the other hand has become insensitive, so that pricking it with a needle produces no sensation.

The observations of this kind have hitherto been made almost, though not quite exclusively, upon patients suffering from certain diseases of the nervous system, and the facts have been described as occurring both in the wakeful and in the mesmeric state. The proximate explanation appears to be, to take the case of transference of sensation just mentioned, that the gentle tactile stimuli caused by the pressure of the coin on the skin, reaching an inhibited centre, sets it in activity, and the sensibility of that part of the skin is restored, but the stimulus passes on to the corresponding and hitherto active centre of the opposite side of the body, and this is inhibited.

Here I must leave the subject. I have not attempted to give an account of all the phenomena of mesmerism; I have taken those phenomena which seemed to me to be the least easy to

understand, the most liable to misconception, and have attempted to show that they resemble fundamentally certain simpler phenomena which can be observed in lower animals. I have further attempted to string together the various facts upon a thread of theory, which may be briefly summed up as follows:—

The primary condition of mesmerism is an inhibition of a particular mode of activity of the cortex of the brain, in consequence of which the will can no longer be made effective.

This inhibition may be brought about by nervous impulses coming from certain sensory nerves, as those of sight, touch, hearing.

It may also be brought about by impulses or changes arising in the cortex itself.

The inhibited cortex, and probably also inhibited lower centres of the brain, send out inhibitory impulses to all other parts of the central nervous system, so that the mesmerised man or animal gradually passes into a state of torpor, or even of complete anæsthesia.

The phenomena of the excitable stage of mesmerism are proximately determined by the possibility of exciting any particular centre alone, without exciting at the same time other centres by which its activity is normally controlled. In lower animals this stage is less marked in consequence of a greater interdependence of the various parts of the central nervous system.

I would expressly state that I regard this theory only as provisional. Further, I am quite conscious that it is very imperfect. A complete explanation of the phenomena of mesmerism and of its allied states can only be given when we have a complete knowledge of the structure and functions of all parts of the central nervous system. But I have not much doubt that the explanation of the main features of mesmerism will be found when we are able to answer the question—What is inhibition? And it is some comfort to think that the answer awaits us in the comparatively simple nervous system of the lower animals. I would not be understood to mean that variation of blood supply and various other events are of no influence in producing mesmeric phenomena; I think, however, that these events are of secondary importance only.

Finally, I would say a word about the attitude of physiologists to animal magnetisers and mesmerists. It has sometimes been made a subject of reproach to physiologists that they have not concerned themselves more actively in investigating mesmeric phenomena. The reproach has very little foundation. The knowledge which has been gained on the subject has been gained almost entirely by medical practitioners and by physiologists, and it must be remembered that until lately most physiologists were also medical practitioners; the division of labour is of recent date.

It is, however, true that in the beginning and middle part of this century there were many scientific men who regarded the subject with a contempt which intrinsically it did not deserve. But in my

opinion they had much justification. A scientific man has always before him some problems which he knows he can solve, or help to solve. He has always before him a road which he knows leads somewhither. Mesmerism was long mixed up with assertions of the transmission of cerebral fluid, with impossible notions which had been banished from physiology, and with charlatanism. The scientific man of that day may, I think, be readily pardoned for supposing that the facts which were given as not more true than the theories, might be equally false. Why should he leave the fruitful work his hand had found to do for that which to all appearance would be barren.

Dr. Esdaile, who although himself not altogether free from blame for mystifying the subject, yet did much to advance it, expresses what must have been a general feeling:—"The ignorance and presumption of man; his passion for the mysterious and marvellous; his powers of self-delusion, with the pranks of knaves and the simplicity of fools, have so mystified the subject, that the artificial difficulties cost us more trouble to remove than the natural; and a mass of rubbish must be got rid of before we can reach the foundation stone of truth."

[J. N. L.]

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